UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/733,608	12/11/2003	Raja Bala	D/A1453	8506

25453 7590 08/21/2008
PATENT DOCUMENTATION CENTER
XEROX CORPORATION
100 CLINTON AVE., SOUTH, XEROX SQUARE, 20TH FLOOR
ROCHESTER, NY 14644

EXAMINER	
CHENG, PETER L	

ART UNIT	PAPER NUMBER
2625	

MAIL DATE	DELIVERY MODE
08/21/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/733,608	BALA, RAJA	
	Examiner	Art Unit	
	PETER L. CHENG	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-7,9-12,14-18 and 20-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-7,9-12,14-18,20-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **5/27/2008** has been entered.

Claim Objections

2. Claim 1 is objected to because of the following informalities:

- **Line 13:** it is assumed that **an input image** refers to **an input image** cited in **line 3**; suggest replacing **an input image** with either **the input image** or **said input image**;

- **Line 14:** it is assumed that **an output device** refers to **an output device** cited in **line 9**; suggest replacing **an output device** with either **the output device** or **said output device**;

3. Claim 10 is objected to because of the following informalities:

- **Line 1:** for clarity, suggest replacing **the image** with **the input image**;

4. Claim 12 is objected to because of the following informalities:

- **Lines 12 - 13:** it is assumed that **an input image** refers to **an input image** cited in **line 3**; suggest replacing **an input image** with either **the input image** or **said input image**;

- **Line 13:** it is assumed that **an output device** refers to **an output device** cited in **lines 8 - 9**; suggest replacing **an output device** with either **the output device** or **said output device**;

Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 1, 3 - 7, 12, and 14 - 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over **SHIRATA [US Patent Application 2002/0008784 A1]** in view of **KASSON [US Patent 5,450,216]**.

As for claims 1 and 12, SHIRATA teaches a ~~gamut mapping~~ luminance dynamic range system

[SHIRATA teaches a "luminance correction method" in which, for example, 8-bit input digital luminance data are corrected to 8-bit output digital luminance data; **page 1, paragraph 25.**

The correction characteristic is either "trapezoidal shaped" [**page 1, paragraph 6, lines 6 - 11**] or "S-shaped" [**page 1, paragraph 6, lines 12 – 16**] and the digital luminance data is corrected according to the selected characteristics; **page 1, paragraph 6, lines 16 – 19]**

comprising:

an image processing module for transforming an input image into a luminance component L_{in} and chrominance components, C_1 and C_2
["In the video reproduction processor 55", as shown in **Fig. 14**, "a YCbCr separator 71 separates the input video data Vin into the luminance data Y and the color difference data Cb and Cr"; **page 5, paragraph 86];**

a spatial low pass filter, responsive to L_{in} for outputting a filtered luminance component L_f, wherein L_f is a function only of L_{in};

and a luminance compression module responsive to L_f and L_{in} for performing luminance compression on the input component L_{in} ~~outputting~~ to output a compressed luminance signal L_{out} that is within an achievable luminance range of an output device
[The "picture corrector" **74** shown in **Fig. 14** corresponds to the "luminance compression module". "The picture corrector 74 corresponds to the luminance corrector shown as an example in FIGS. 3 – 6, and corrects the output luminance data Y of the contour emphasizer 73 in accordance with the ... trapezoidal characteristic or S-shaped characteristic"; **page 5, paragraph 93, lines 3 - 7];**

wherein the luminance compression module combines two compression functions $L_{comp1}(L_{in})$ and $L_{comp2}(L_{in})$ via a blending function $\alpha(L_f)$

[As illustrated in **Fig.** 2, the "S-shaped characteristic" transforms *input digital luminance data* (i.e., INPUT) into *output digital luminance data* (i.e., OUTPUT). SHIRATA teaches that the "whole input data region is divided into three regions 1, 2, and 3"; **page 2, paragraph 41, lines 1 – 4.**

The "solid line, S-shaped characteristic" is composed of three line segments. In the example shown in **Fig. 2**, the *first line segment* in region 1 has endpoints (00h, 00h) and (40h, 20h), the *second line segment* in region 2 has endpoints (40h, 20h) and (C0h, E0h), and the *third line segment* in region 3 has endpoints (C0h, E0h) and (FFh, FFh).

The *third line segment* may be considered a portion of a *first luminance compression function* whose endpoints are (00h, 80h) and (FFh, FFh) with a slope of ½. For the purpose of claim interpretation, this *first luminance compression function* corresponds to $\mathbf{L_{comp1}(L_{in})}$.

Similarly, the *first line segment* may be considered a portion of a *second luminance compression function* whose endpoints are (00h, 00h) and (FFh, 80h) with a slope of ½. For the purpose of claim interpretation, this *second luminance compression function* corresponds to $\mathbf{L_{comp2}(L_{in})}$.

As shown in **Fig.2**, the *second line segment* in region 2 can be considered as being generated by a blending of the *first* and *second luminance compression functions*. Such a blending function would have a value of "0" in region 1 for input luminance values 00h through 40h, a value of "1" in region 3 for input luminance values C0h through FFh, and a linearly increasing value of "0" to "1" in region 2 for input luminance values 40h through C0h. Although not shown, this blending function would correspond to blending function **$\alpha(L_f)$];**

~~and~~ ~~wherein~~ $L_{comp1}(L_{in})$, $L_{comp2}(L_{in})$ and $\alpha(L_f)$ are all 1-dimensional functions only of L_{in}

[As noted, and as inferred from **Fig. 2**, the *first luminance compression function, second luminance compression function* and the *blending function* are all 1-dimensional functions only of the input luminance**];**

and wherein $L_{comp1}(L_{in})$ and $L_{comp2}(L_{in})$ are both designed to map the luminance dynamic range of an input image to the more limited dynamic range of an output device

[As noted, both *first luminance compression function* and *second luminance compression function* are illustrated as having a slope of ½. With a slope less than 1, the luminance dynamic range is compressed**].**

However, SHIRATA *does not specifically teach*

a spatial low pass filter, responsive to L_{in} for outputting a filtered luminance component L_f, wherein L_f is a function only of L_{in};

KASSON cites prior art that teaches "limiting the gamut-mapping adjustment of luminance to the low spatial frequency components because human vision is less sensitive to luminance changes at the lower spatial frequencies"; **col. 3, lines 48 – 52.**

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of KASSON with those of SHIRATA and apply a "spatial low pass filter" to the input digital luminance data values (L_{in}) to produce filtered luminance values (L_f) and to make the blending function $\alpha(L_f)$ dependent on the filtered luminance component (L_f) so that luminance changes are not easily perceived.

Regarding claims 3 and 14,

wherein L_{out} is computed according to the relationship

$$L_{out} = \alpha(L_f)\, L_{comp1}(L_{in}) + (1 - \alpha(L_f))\, L_{comp2}(L_{in}).$$

As noted for claims 1 and 12, the "S-shaped characteristic" produces *output digital luminance data* (L_{out}) of the form shown by the relationship above.

Regarding claims 4 and 15, wherein

$\alpha(L_f)$ is a piecewise linear function,

determined by two breakpoints, B_1 and B_2.

and claims 7 and 18, wherein

$\alpha(L_f) = 0$ for values of L_f between 0 and B_1;

$\alpha(L_f)$ increases linearly from 0 to 1 for values of L_f from B_1 to B_2;

and $\alpha(L_f) = 1$ for values of L_f between B_2 and L_{max},

where L_{max} is a maximum luminance achievable by the output device.

As noted for claims 1 and 12, a blending function **$\alpha(L_f)$** can be inferred from the "S-shaped characteristic" that produces *output digital luminance data* (**L_{out}**). Breakpoints **B_1** and **B_2** would correspond to points "A" and "C" (shown in **Fig. 2**), respectively.

However, it should also be noted that the current claims do not specify and the specification does not appear to teach how compression functions **$L_{comp1}(L_{in})$** and **$L_{comp2}(L_{in})$** *differ* in relation to the breakpoints **B_1** and **B_2**.

For instance, if **$L_{comp1}(L_{in})$** and **$L_{comp2}(L_{in})$** were identical except in the shadow region (i.e., region 1), and breakpoints **B_1** and **B_2** were located in the midtone or highlight regions, the resulting luminance compression function **L_{out}** would be identical to the (prior art) "inverse-gamma-inverse function" adjusted at the black point, **$L_{comp2}(L_{in})$**.

Regarding claims 5 and 16,

wherein function L_{comp1} is optimized for preserving overall image contrast.

As noted for claims 1 and 12, the *first luminance compression function* corresponds to $L_{comp1}(L_{in})$. Since it has a non-zero slope, it "preserves" image contrast, and since it, as interpreted, spans from (00h, 80h) to (FFh, FFh) covering all input luminance values, it also preserves "overall" image contrast.

Regarding claims 6 and 17,

wherein function L_{comp2} is optimized for preserving shadow detail.

As noted for claims 1 and 12, the *second luminance compression function* corresponds to $L_{comp2}(L_{in})$. Since it also has a non-zero slope, it "preserves" image contrast, and since it, as interpreted, spans from (00h, 00h) to (FFh, 80h) covering all input luminance values, it also preserves "overall" image contrast (including "shadow" region 1).

8. Claims 9 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over **SHIRATA [US Patent Application 2002/0008784 A1]** in view of **KASSON [US Patent 5,450,216]** and **GRUZDEV [US Patent 6,868,179 B2]**.

Regarding claims 9 and 20, SHIRATA and KASSON *do not specifically teach* the system of claim 1, or the method of claim 12, respectively,

wherein the low pass filter comprises a constant weight filter.

However, GRUZDEV discloses a method of correcting image saturation. GRUZDEV teaches that a *chrominance component* "may be smoothed by any method well known in the art, for example, a Gaussian filter, and *averaging filter* or other low-pass filter"; **col. 5, lines 60 – 62.** An *averaging filter* over a specified number of input image pixels is a "constant weight" filter.

Although applied to the *chrominance component*, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a "constant weight" averaging filter to low-pass filter input luminance values since an averaging filter is relatively simple to implement.

9. Claims 10 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over **SHIRATA [US Patent Application 2002/0008784 A1]** in view of **KASSON [US Patent 5,450,216]** and **MORONEY [US Patent Application 2002/0186387 A1]**.

Regarding claims 10 and 21, SHIRATA and KASSON *do not specifically teach* the system of claim 1, or the method of claim 12, respectively,

> **wherein the image is down-sampled prior to filtering and upsampled and interpolated after filtering.**

MORONEY teaches a method of correcting colors of an input image by "locally modifying the input pixel values according to pixel neighborhoods" **[Abstract].**

MORONEY discloses a method for generating a "tone mask through a low-pass filtering operation"; **page 2, paragraph 23, lines 1 – 2.** MORONEY filters the luminance component of the color image. "The process initially converts (at 205) the received color image to a monochrome image (i.e., an image that only contains black and white pixels, or contains black, white, and gray values)"; **page 2, paragraph 23, lines 3 – 6.** After "inverting the monochrome image" **[page 2, paragraph 24, lines 1 - 2],** the process "decimates (at 215) the inverted monochrome image. Some embodiments decimate this image by selecting every nth (e.g., 20^{th}) horizontal and vertical pixel in this image ..., and discarding the remaining pixels"; **page 2, paragraph 24, lines 6 – 11.** "Decimation" is "down-sampling" of an image.

Next, the process filters the image by performing "(at 220) a smoothing operation on each pixel in the decimated, inverted, monochrome image"; **page 2, paragraph 25, lines 1 – 3.**

After filtering, the process "upsamples and interpolates" by scaling "(at 225) the smoothed, decimated, inverted, monochrome image back up to the resolution of the original received image"; **page 2, paragraph 26, lines 1 – 3.**

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of MORONEY and KASSON with those of

SHIRATA and down-sample the image data prior to filtering and up-sampling/ interpolating after filtering so as to reduce the computational time and load on the system.

10. Claims 11 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over **SHIRATA [US Patent Application 2002/0008784 A1]** in view of **KASSON [US Patent 5,450,216]** and **ESCHBACH [US Patent 6,342,951 B1]**.

Regarding claims 11 and 22, SHIRATA and KASSON *do not specifically teach* the system of claim 1, or the method of claim 12, respectively, further comprising

> **a color correction module for transforming L_{out}, C_1 and C_2 to CMYK for printing.**

KASSON does teach that "many different display devices and printing devices can be devised for color imaging, each represented by a different display gamut boundary" **[col. 6, lines 27 – 30]** and that an ink-jet printer may use cyan, magenta, yellow and black ink colors; **col. 6, lines 15 – 17.**

ESCHBACH teaches a method for mapping out-of-gamut colors into an output gamut, such as a printer gamut. **Fig. 5** illustrates the production of "gamut clipped color" data for a "CMYK" printer and the transformation of that data to CMYK for printing (see "printer transformation" step **S3**). Although Fig. 5 illustrates the invention in RGB color

space, ESCHBACH teaches "that it is equally applicable to any other color space" **[col. 5, lines 63 - 66]** as in a luminance-chrominance CIELAB color space shown in Figs. 3 and 4; **col. 5, lines 23 - 26].**

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of ESCHBACH and KASSON with those of SHIRATA to transform the resulting luminance and chrominance values to a printer color space such as CMYK when the desired target output device is a printer.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter L. Cheng whose telephone number is 571-270-3007. The examiner can normally be reached on MONDAY - FRIDAY, 8:30 AM - 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, King Y. Poon can be reached on 571-272-7440. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/King Y. Poon/
Supervisory Patent Examiner, Art Unit 2625

plc
August 18, 2008